First Grade
Water Quality

Water---It's a Gas…Sometimes!

LEARNING OBJECTIVE

The students will understand that water can be a solid, liquid or a gas and will begin to understand some properties of water.

STUDENT PERFORMANCE OBJECTIVES

* The student will recognize the importance of water and how much of the Earth's water is available as fresh water.
* The student will understand that water can be found in three forms within the Earth's normal temperature range.
* The student will begin to understand the chemistry of water.
* The student will begin to understand surface tension and cohesion.
* The student will begin to identify the difference between a solution and a suspension.
* The student will begin to understand that water properties can affect water quality.
* The student will understand that methods of disposal of household chemicals can affect water quality.

BACKGROUND

Water is the most common substance on Earth. Every living organism needs water to survive. Although approximately 75% of the Earth's surface is covered with water, only about 1% is available freshwater for sustaining all life on Earth. (see water cycle lesson)

Water, like all matter, contains tiny particles called molecules. A drop of water contains millions of molecules. Each molecule contains smaller particles called atoms. Water molecules consist of two hydrogen atoms and one oxygen atom. The chemical symbol for water is H_2O.

Water can be a liquid, gas or solid. Water is the only substance on Earth that can naturally occur in three different forms. The form water takes depends on how fast the molecules are moving. As a solid (ice) the water molecules are far apart and move very slowly. As a liquid, the molecules are close together and move freely. When water is a gas, the molecules are very close. They move about violently and bump into each other. The rate of water molecule movement depends on the water temperature.

Surface tension is the force that causes the surface of water to appear as if a thin, elastic (almost skin-like) film covers it. The spherical shape of water drops is due to surface tension. Surface tension allows the surface of water to support objects. Cohesion refers to the attraction between the water molecules. Cohesion causes surface tension.

Water is an almost universal solvent. This makes it very easy for water to contain many dissolved substances. Some of those substances can adversely affect water quality. Toxic substances, hazardous chemicals, pesticides and minerals can all be polluters of water. When one substance mixes (dissolves) into water, a solution is formed. When particles of a substance do not dissolve, a suspension is formed. Gas and oil as well as solids do not mix with water and are water pollutants. Sewage, industry, and agriculture are all sources of water pollution. When people dispose of household products like paint, bug spray, nail polish and household chemicals by pouring them down drains or adding them to the landfills, these chemicals can seep into our groundwater or reservoirs and affect water quality. Water trapped beneath the ground is groundwater. Because water is a solvent, it can collect small amounts of whatever it comes in contact with. Rains that soak in, rivers that flow underground in certain areas, and melting snow are all sources of groundwater (for more information see watershed lesson). Due to its many sources, groundwater may contain many contaminants such as pesticides, insecticides, industrial wastes, as well as dissolved minerals. Scientists have developed tests to determine water quality. These tests measure foreign matter (microorganisms, chemicals, industrial or other wastes) as well as the physical/chemical condition of the water (temperature, dissolved oxygen, pH, etc.).

Several kinds of scientists study water. Hydrologists study water-related problems in society such as problems of quantity, quality and availability. Limnologists study water and aquatic life in freshwater. Oceanographers study water and aquatic life in saltwater.

<for more>

MATERIALS

* Waxpaper, approximately a 6 inch square per student
* Cup to hold small amount of water, one per student
* Powdered drink (Kool-Aid®, lemonade, etc.) enough to mix for each child to get a drink
* Pitcher of water to mix powdered drink mix
* Drinking cups, one per student

* Jar, one pint or larger
* Oil, vegetable or motor
* Four paper signs that say Hydrogen on one side and Water on the other side
* Two paper signs that say Oxygen on one side and Water on the other side
* Pepper
* Cups-one per group of students (procedure 7)
* Recording sheet [WQlty/1-1]
* Eyedropper
* www.ecoplex.unt.edu

OPENING

Ask the class:

What do you know about water?

PROCEDURE

1. The opening question should allow you to gauge the class's level of water knowledge. Lead the discussion to cover: how much of the Earth is water, how much of the Earth's water is usable fresh water, the water cycle, kinds of water, water sources, and uses of water. For more information and activities to introduce these concepts if they are unfamiliar to your class, see water cycle and watershed lessons**.** The procedures in this lesson are divided by the concepts: *states of water*, *chemistry of water*, *surface tension*, *water as a solvent*, and *water quality.*

   The states of water:

2. Explain that water is the most common and one of the most unusual substances in our lives. No other substance can be a liquid, solid or gas within the Earth's normal temperature range. Ask the students to identify the different states of water. (Examples: liquid--faucet water, rain, lakes, etc.; solid--ice, popsicles, etc.; gas--water vapor as seen in clouds, steam, during evaporation and transpiration.)

3. Show the students hand movements to show the three "states" of water. To demonstrate a solid, hold hands in front of you with palms facing each other approximately 24 inches apart and barely moving back and forth. To demonstrate a liquid, let your hands do a hand over hand rolling movement in front of your chest area. To show a gas, move your hands in a rolling motion in big sweeps in front of the torso area of your body. Explain that when water is a solid (ice) the molecules are far apart and almost still. In a liquid state (rain), the molecules are close together, but move more freely. As a gas, the molecules are close together. They move about violently and bump into

each other as they vaporize. Remind the students of boiling water as it turns to water vapor (gas).

4. Call out different items that contain water while the students demonstrate their understanding of water molecules with their hand movements. (*Solids*: ice, glacier, ice caps, icebergs, etc., *Liquids*: soda pop, rain, creek, soup, etc., *Gas*: steam, cloud, etc.)

   The chemistry of water:

5. Explain to the students that water, like all matter, consists of tiny molecules. A drop of water contains millions of molecules. Each molecule consists of even smaller particles called atoms. One oxygen atom and two hydrogen atoms when combined make water. (Remind them that they are breathing oxygen right now.) A simple sketch might help the student visualize the two hydrogen atoms and one oxygen atom combining to form water. Choose six students to pick up a hydrogen or oxygen sign and challenge them to "join" to form a water molecule. When they think they've formed a water molecule, they will turn their signs over to show water. Repeat, allowing all students to have a turn.

   Surface tension:

6. Give each student a square of waxpaper with a drop (or two) of water. Allow the students to watch the drop roll around. Be sure they observe that the water drop appears to have a skin around it that holds it in a sphere. This property of water is called surface tension. As they observe, remind them that each drop contains millions of molecules and inside each molecule there are tiny atoms of hydrogen and oxygen!

7. Divide the class into groups of 2 or 4. Give each group of students a small container or cup of water and pepper to shake on top of the water. (This could be demonstrated using the overhead projector before each group gets their own supplies.) When pepper is shaken on the water, most of the pepper floats on top due to surface tension. Add one drop of liquid soap to the water. The pepper scatters to the side of the container because the soap causes a break in the surface tension.

8. Ask the students if they have ever seen water striders or other insects move or rest on the surface of a pond or other body of water. Surface tension allows the insects to stay on top of the

water because their legs don't break the surface tension.

Water as a solvent:

9. Take out the pitcher of water, powdered drink mix and cups for each child. Show the drink powder. Mix it in the pitcher. Pour each child a drink. Ask the students what happened to the powder when you mixed it with water. Remind them of the molecules of water. The molecules of powder mixed completely with the molecules of water. Explain that when one substance dissolves (mixes) in another one we call it a solution. Think of other solutions (other drinks made with powder, cheese sauces made with powdered cheese, etc.). Another interesting property of water is that in it's liquid state, water is an almost universal solvent. This means many things dissolve in water. Ask if the students can think of other things that dissolve in water.

10. Ask if all liquids dissolve in water. Encourage the students to give examples. Fill a jar ½ full of water. Add vegetable oil, motor oil, or other type of oil. Shake the jar and ask students to describe what they see. Explain that when two substances don't mix, it's called a suspension. They may have seen this in oil and vinegar dressing, tomato juice or other unstrained liquids. Ask what they think is happening to the molecules of oil and water.

Water quality:

11. Explain that sometimes chemicals, oils and other substances get into water that make it dirty or polluted. Sometimes we can see or smell when water is polluted, but not always. Some chemicals dissolve in water—like the powdered drink mix. These could be pesticides and fertilizers that we use on our lawns and that farmers use on croplands. (Share background information.) Other substances like oil and grease don't dissolve in water. They stay on the surface.

12. Our drinking water and natural water (lakes, reservoirs, ponds, etc.) are tested to be sure they are "clean" for their intended use. Water quality is based on not having too many "bad" things (pollutants) and enough "good" things such as oxygen. These "things" vary depending on the use of the water.

13. Locate www.ecoplex.unt.edu. Show the students the various information available. Explain that the water quality section allows us to see the test results for Lake Lewisville. Help the children realize that water quality is very important, and that scientists test water to monitor water quality. Look at some of the data available. Encourage the students to notice the different tests that are ongoing.

14. Since many things that go down our drains or into the ground eventually enter our water supply, it is important for each of us to monitor what we put down our drains or throw away in our trash. The way our families and industries dispose of wastes may damage our water supply. (see watershed lesson)

15. When we dispose of household chemicals according to the directions on the containers, we are protecting both our drinking water supply and the natural waters in our watershed.

SO WHAT?
(LIFE APPLICATION)

Students will discuss with their families how to dispose of household chemicals. Using recording sheet [WQlty/1-1], families will list a few products found in their homes, read disposal guidelines, record, and return the sheet to school.

CURRICULUM EXTENSIONS

Science

Sink and Float-set up a sink and float discovery center. Try the objects in saltwater and freshwater. Are there any differences?

In the science center, set up several things that could be mixed with water to see if a solution is formed (salt, sugar, sand, etc.)

Surface Tension-Fill a clear plastic cup completely full of water. Ask if the students think the cup will spill over if you add a penny to the cup. Gently slide a penny down the side of the cup. Let children help you continue sliding pennies in until it spills over. (This will take about 50 pennies)

Math

Predict how many pennies will be added to the cup in the above activity before the water spills over.

Give each child a penny, a cup of water and an eyedropper. Ask them to predict how many drops of water they think their penny will hold (as a result of surface tension). Record the predictions. Record the results. Will "heads" or "tails" hold more water?

Social Studies

Invite a classroom speaker from the water quality office in your community.

Schedule a field trip to the wastewater or water treatment plant.

Try to arrange a field trip to a creek, pond or other natural body of water to observe the habitat. City parks often have ponds or creeks.

Art

Ice Sculptures-Freeze ice in many different containers. Using big blocks of ice as a base, attach other ice shapes to the big blocks. This can be accomplished by using table salt as a glue (do not use rock salt). Drip food coloring on the sculpture to add color.

Language Arts

Allow the children to gather clean, empty product containers that the contents have been disposed of properly. Share disposal information with other classes.

TEKS

Science: 1.1A,B, 1.2A,C,D,E, 1.3A,B,C, 1.4B, 1.9A,B

RESOURCES

FAQ's

Related Children's Literature:

Solid, Liquid, or Gas by Sally Hewitt

Water by Frank Asch

A Drop Around the World by Barbara McKinny

Follow a Raindrop by Elsie Ward

What Will Float? by Fred and Jeanne Biddulph

What Makes It Rain? by Keith Brandt

The Magic School Bus at the Waterworks by J. Cole and B. Degan